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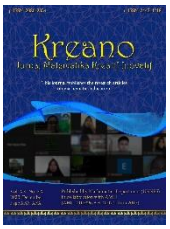

Development of Student Worksheet Based on Local Cultural Ethnomathematics on Quadrilateral and Triangle Topics

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Abstract

The lack of mathematics instructional materials integrating local culture has made geometry learning remain abstract and less contextual for students. In addition, the development of ethnomathematics-based student worksheet utilizing Pontianak local culture in quadrilateral and triangle topics is still limited. This study aimed to develop a valid and practical ethnomathematics-based student worksheet rooted in Pontianak local culture for seventh-grade students. The study employed a Research and Development (R&D) method using the Plomp model, consisting of preliminary research, prototyping, and assessment phases. Product validity was evaluated by six validators, including two content experts, two media experts, and two language experts, using content validity measured through Gregory's Index. The practicality test involved 30 seventh-grade students and one mathematics teacher at a public junior high school in Sungai Kakap in the 2023/2024 academic year using user response questionnaires. The results showed that the developed student worksheet achieved a validity coefficient of 1.00 , categorized as high validity in content, media, and language aspects. The practicality test obtained a percentage score of 82.72%, categorized as very practical. This study contributes to the development of an ethnomathematics-based student worksheet that integrates Pontianak local culture into quadrilateral and triangle topics. This student worksheet can serve as an alternative learning resource to facilitate more contextualized and culturally relevant mathematics learning that is closely connected to students' cultural experiences.

Keywords: Student Worksheet; Ethnomathematics; Local Culture; Quadrilaterals and Triangles

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Abstrak

Kurangnya bahan ajar matematika yang mengintegrasikan budaya lokal menyebabkan pembelajaran geometri masih bersifat abstrak dan kurang kontekstual bagi peserta didik. Selain itu, pengembangan LKPD berbasis etnomatematika yang memanfaatkan budaya lokal Pontianak pada materi segiempat dan segitiga masih terbatas. Penelitian ini bertujuan mengembangkan LKPD berbasis etnomatematika yang berakar pada budaya lokal Pontianak yang valid dan praktis untuk peserta didik kelas VII. Penelitian menggunakan metode Research and Development (R&D) dengan model Plomp yang meliputi tahap penelitian pendahuluan, prototipe, dan penilaian. Validitas produk dinilai oleh enam validator yang terdiri atas dua ahli materi, dua ahli media, dan dua ahli bahasa menggunakan validitas isi melalui indeks Gregory. Uji kepraktisan dilakukan kepada 30 peserta didik kelas VII dan satu guru matematika di salah satu SMP Negeri di Sungai Kakap tahun pelajaran 2023/2024 menggunakan angket respons pengguna. Hasil penelitian menunjukkan bahwa LKPD memperoleh koefisien validitas sebesar 1,00 dengan kategori validitas tinggi pada aspek materi, media, dan bahasa. Hasil uji kepraktisan memperoleh persentase sebesar 82,72% dengan kategori sangat praktis. Penelitian ini berkontribusi dalam menyediakan LKPD berbasis etnomatematika yang mengintegrasikan budaya lokal Pontianak pada materi segiempat dan segitiga. LKPD ini dapat menjadi alternatif bahan ajar untuk mendukung pembelajaran matematika yang lebih kontekstual dan relevan dengan pengalaman budaya peserta didik.

INTRODUCTION

Mathematics learning, particularly in geometry, is often perceived by students as difficult because the instructional process tends to emphasize abstract concepts and memorization of formulas without connecting them to students' real-life experiences. As a result, students frequently experience difficulties in understanding contextual mathematical problems and applying mathematical concepts in everyday situations (Cahirati et al., 2020; Orey & Rosa, 2021). Although mathematics plays an important role in developing logical, analytical, and systematic thinking skills, learning practices in schools are still commonly dominated by teacher-centered instruction and decontextualized materials. Therefore, there is a need for contextual learning approaches that can bridge mathematical concepts with students' cultural and daily experiences.

These concerns are consistent with Prahmana et al. (2021), who argue that mathematics is often taught in ways that are disconnected from students' socio-cultural contexts. This is despite the assertion by Anggraini and Syahbrudin (2021) that teachers should be able to develop learning materials that align with the curriculum, students' needs, experiences, and capabilities, while also considering the socio-cultural environment in which the learning takes place. This indicates a clear need for the development of culturally contextualized instructional materials that can bridge abstract mathematical concepts with students' real-life cultural experiences.

A preliminary study conducted at a seventh-grade class in a public junior high school in Sungai Kakap reinforced these findings. Interviews with the mathematics teacher revealed that the instructional materials used in class tend to be theoretical and do not integrate mathematical concepts with students' local cultural context. As a result, students frequently experience difficulties in identifying the properties of quadrilaterals and triangles, applying geometric concepts to contextual problems, and explaining the characteristics of geometric shapes beyond memorized formulas. These challenges indicate that the existing instructional materials have not adequately supported students in connecting abstract geometric concepts with meaningful and culturally relevant real-life situations.

One approach that can support contextual mathematics learning is

ethnomathematics. Ethnomathematics integrates mathematical concepts with cultural practices and local wisdom so that learning becomes more meaningful and relevant to students' social environments (Orey & Rosa, 2021). This concept places mathematics within the framework of local community values, customs, and practices to increase the relevance of learning, strengthen student identity, and foster more meaningful understanding (Marsigit et al., 2025). Through this approach, Rosa and Orey (2020) emphasize that ethnomathematics-based learning helps students view mathematics as an integral part of daily life, thereby strengthening their conceptual understanding and ability to make meaningful connections between mathematical concepts and their cultural realities.

The benefits of ethnomathematics-based learning have been supported by a growing body of empirical evidence. Previous studies have shown that ethnomathematics-based learning can increase students' engagement, motivation, and conceptual understanding by connecting mathematics with familiar cultural contexts (Prahmana et al., 2021; Rosa & Orey, 2020). This is further supported by Garba (2024), who found that students taught geometry using an ethnomathematics instructional approach demonstrated higher interest ratings, achievement, and retention scores compared to those taught through conventional methods.

One practical form of ethnomathematics integration in mathematics instruction is the development of student worksheet. Ethnomathematics-based student worksheet can facilitate active learning by guiding students through structured activities and contextual problem-solving tasks, helping them explore mathematical concepts through cultural contexts that are close to their daily lives. Nurmaya (2021) noted that ethnomathematics-based student worksheet offer a unique approach that significantly improves students' learning motivation, while Vitoria and Monawati (2020) emphasize that the integration of ethnomathematics-based learning resources contributes to more meaningful learning experiences. Furthermore, Sholihah et al. (2022)suggest that student worksheet designed by linking mathematical concepts to everyday life are not only valid and practical but also effective in supporting learning outcomes. Despite these promising findings, research on the systematic development of ethnomathematics-based student worksheet, particularly those grounded in the local culture of West Kalimantan, remains limited.

To date, various studies have explored the ethnomathematical elements found within the cultural practices of West Kalimantan communities. These include investigations of traditional games such as Tabak (Listari et al., 2024), the architectural design of the Jami' Sultan Syarif Abdurrahman Mosque in Pontianak (Faruq, 2023), traditional Malay houses in Pontianak (Ridha & Komalasari, 2024), and the motifs of *Corak Insang* weaving in Pontianak (Jamilah & Nurmaningsih, 2024). However, existing studies have primarily focused on ethnomathematical exploration rather than the development of student worksheet. One notable exception is the study by Putra et al. (2023), which developed ethnomathematics-based student worksheet using the context of traditional Pontianak market snacks to

teach three-dimensional geometric shapes. Furthermore, no study has developed an ethnomathematics-based student worksheet that integrates Pontianak cultural elements into the learning of quadrilaterals and triangles for junior high school students.

This gap indicates the urgency of developing culturally contextualized instructional materials that can support geometry learning while simultaneously preserving local cultural values. Integrating Pontianak cultural elements into quadrilateral and triangle learning may provide familiar visual and contextual representations that support students' understanding of geometric concepts. Therefore, this study aims to develop an ethnomathematics-based student worksheet rooted in Pontianak local culture on quadrilateral and triangle topics for seventh-grade students, addressing a context and topic combination that has not been explored in previous studies.

METHOD

This study employs the Research and Development (R&D) method to develop an ethnomathematics-based student worksheet rooted in local culture, focusing on the topics of quadrilaterals and triangles, with the objective of ensuring its validity and practicality. The development process follows the Plomp model (Plomp & Nieveen, 2010) which comprises three key phases: (1) preliminary research, (2) prototyping, and (3) assessment. Figure 1 presents the flow of the development process based on the Plomp model.

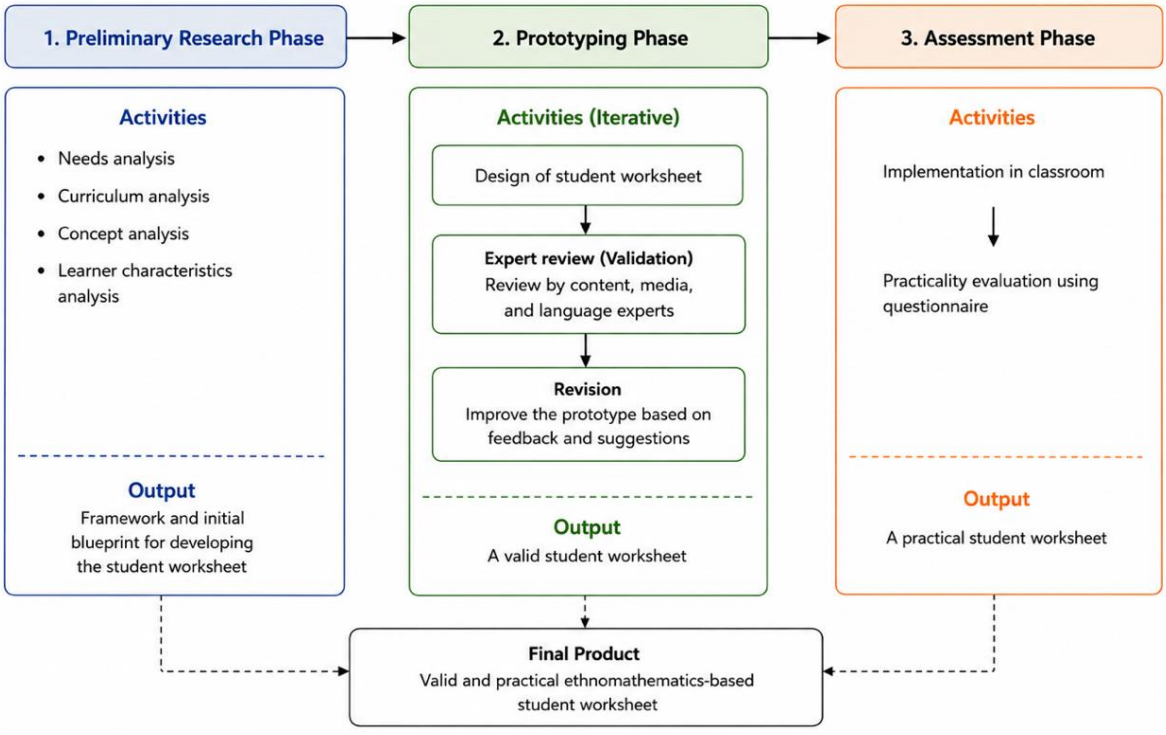

Figure 1. Flowchart of the Development Process Based on the Plomp Model

The preliminary research phase encompassed four interconnected analyses, namely needs analysis, curriculum analysis, concept analysis, and learner characteristics analysis. The output of this phase was a framework

and initial blueprint that served as the foundation for developing the student worksheet. The prototyping phase involved iterative activities comprising the design of the student worksheet, expert review and revision. The output of this phase was a valid student worksheet that met the required content, media, and language quality standards. The assessment phase focused on evaluating the practicality of the developed worksheet through classroom implementation. The output of this phase was a practical student worksheet. The final product resulting from all three phases was a valid and practical ethnomathematics-based student worksheet on quadrilateral and triangle topics for seventh-grade students.

The research was conducted in a seventh-grade classroom a public junior high school in Sungai Kakap Kubu Raya Regency during the 2023/2024 academic year. Data were collected from 30 seventh-grade students and one mathematics teacher to evaluate the practicality of the product, while validity was assessed by six expert validators, including two content experts, two media experts, and two language experts. The school is located in Sungai Kakap, Kubu Raya Regency, an area that is closely connected to the cultural traditions of Pontianak and the surrounding Malay community. Students are familiar with various local cultural artifacts, traditional foods, and architectural elements that were incorporated into the ethnomathematical contexts presented in the worksheet. This cultural background was considered during the development process to ensure that the learning materials were relevant to students' daily experiences.

Two instruments were used to collect the data, namely a product validity questionnaire and a product practicality questionnaire. Following Ferdian et al. (2025), product validity was assessed to determine whether the developed teaching material met the criteria required for classroom implementation. The product validity questionnaire was used to assess the quality of the developed student worksheet in terms of content, media, and language. Content validation covered the accuracy, relevance, and presentation of the learning material. Media validation focused on visual design, typography, layout consistency, and the alignment of the worksheet design with the ethnomathematical context. Language validation assessed clarity and communicativeness, interactivity and dialogue, appropriateness for students' characteristics, and the use of terms and symbols. The validity questionnaire used a 5-point Likert scale with the following assessment criteria (1 = Not Valid, 2 = Slightly Valid, 3 = Moderately Valid, 4 = Valid, 5 = Highly Valid).

The product practicality questionnaire was administered to both teachers and students to evaluate the practicality of the developed ethnomathematics-based student worksheet during classroom implementation. The questionnaire assessed several aspects, including ease of use, clarity of instructions, attractiveness of design, relevance of cultural content, and support for learning activities. The indicators used in the instrument were adapted from established criteria for educational material evaluation and aligned with the objectives of developing an ethnomathematics-based student worksheet.

Quantitative descriptive analysis was conducted on the expert validation data by computing content validity

coefficients using Gregory's Index. The first category, consisting of not valid (score 1), slightly valid (score 2), and moderately valid (score 3) items, was reclassified as irrelevant. The second category, comprising valid (score 4) and highly valid (score 5) items, was reclassified as relevant. Subsequently, a contingency table was constructed comparing the assessments of two experts (Expert 1 and Expert 2) across these irrelevant and relevant categories as shown Table 1.

Table 1. Contingency Matrix for Inter-rater Agreement Analysis

		Expert 1	
		Irrelevant	Relevant
Expert 2	Irrelevant	A	B
	Relevant	C	D

After determining the contingency categories, the next step was to calculate the content validity coefficient using Gregory's contingency table approach. This method allows researchers to quantify the degree of agreement between expert validators regarding the relevance of each item or aspect being evaluated. The Gregory coefficient provides a statistical measure of content validity, reflecting the extent to which experts consistently classify the evaluated components as relevant or irrelevant. The formula used to calculate the Gregory content validity coefficient is presented below:

$$V = \frac{D}{A+B+C+D} \quad \ldots\ldots (1)$$

Where:

A = Cases where both experts assign identical irrelevance scores (1-3 on the same items)

B = Cases where experts assign conflicting scores (one rates 1-3 while the other rates 4-5 on the same item)

C = Cases where experts assign different but non-conflicting scores (e.g., one rates 2 and the other rates 3, both within the 1-3 irrelevance range)

D = Cases where both experts assign identical relevance scores (4-5 on the same items)

(Retnawati, 2016)

The obtained content validity coefficient was then interpreted into three categorical levels, representing the degree of agreement among validators. These categories serve as indicators of the extent to which experts consistently evaluate the appropriateness and accuracy of the developed instrument, as presented in Table 2.

Table 2. Validity Level

Coefficient Range	**Validity Level**
0,8 - 1,0	High Validity
0,4 - 0,79	Moderate Validity
0 - 0,39	Low Validity

The practicality level of the developed student worksheet was assessed using a student response questionnaire administered to seventh-grade students following the implementation of the worksheet in the classroom. The questionnaire data were then quantified by calculating the percentage score of student responses using the following formula:

$$P = \frac{TS_e}{TS_m} \times 100\% \quad \ldots\ldots (2)$$

Where:

P = Practicality level

TS_e = Total empirical score obtained from respondents

TS_m = Maximum possible score

The practicality level of the developed student worksheet was

determined based on the criteria presented in Table 3, which served as a reference for interpreting the percentage scores obtained from student responses. Each percentage range corresponds to a practicality category, ranging from very impractical to very practical. The developed student worksheet was considered successfully practical if the percentage score obtained reached at least the practical category.

Table 3. Product Practicality Criteria

Qualification Score Range	Category
80% < P ≤ 100%	Very Practical
60% < P ≤ 80%	Practical
40% < P ≤ 60%	Fairly Practical
20% < P ≤ 40%	Less Practical
0% < P ≤ 20%	Very Impractical

RESULT AND DISCUSSION

Results

Preliminary Research Phase

This research and development study aims to design and produce an ethnomathematics-based student worksheet focused on the topics of quadrilaterals and triangles. The ethnomathematical elements integrated into the student worksheet are derived from the rich local cultural context of Pontianak City, reflecting its traditional art forms, architecture, and cultural heritage. The research process employs the Plomp development model, which consists of three systematic phases: (1) the preliminary analysis phase, involving needs assessment and context exploration; (2) the prototyping phase, encompassing the design and iterative refinement of the student worksheet; and (3) the assessment phase, focusing on the validation and practicality evaluation of the developed product.

During the preliminary analysis phase, the researchers conducted a needs analysis, curriculum analysis, concept analysis, and learner characteristics analysis to establish a strong foundation for product development, as reported by Sulisti et al. (2025). The preliminary research revealed several issues that justified the development of an ethnomathematics-based student worksheet. The needs analysis indicated that the textbook used by teachers was insufficient to support an in-depth understanding of quadrilateral and triangle perimeter and area concepts. Classroom instruction relied heavily on textbooks and teacher explanations, resulting in limited variation in learning activities and reduced student engagement. In addition, the exercises provided were generally simple and lacked contextual relevance, making it difficult for students to connect mathematical concepts with real-life situations.

The analysis of learner characteristics showed that students had varying levels of prior knowledge regarding quadrilateral and triangle topics as well as local cultural knowledge. Furthermore, Pontianak possesses rich local cultural elements that can be integrated into mathematics learning. These findings suggest the need for instructional materials that incorporate meaningful contextual problems and local cultural contexts. Therefore, an ethnomathematics-based student worksheet was developed to facilitate students' discovery of mathematical concepts through activities related to their daily experiences and presented in a manner appropriate to the characteristics of seventh-grade students.

Prototyping Phase

After completing the needs analysis, the study proceeded to the prototyping

phase, in which the ethnomathematics-based student worksheet on quadrilateral and triangle topics was designed and developed. The content was structured to align with the learning objectives and outcomes specified in the Merdeka Curriculum for seventh-grade mathematics. In developing the worksheet, three key requirements were considered. The didactic requirement ensured that the worksheet supported active student learning through structured guided activities, contextual problems, and discovery-based tasks. The constructive requirement ensured that the language, instructions, and tasks were appropriate for seventh-grade students in terms of cognitive level and readability. The technical requirement ensured that the visual layout, typography, and illustrations met the standards of a well-structured and visually appealing instructional material.

The ethnomathematical contexts integrated into the student worksheet were derived from Pontianak local culture, including traditional architecture, woven motifs, traditional games, and local foods. Specifically, cultural objects such as the Jami' Sultan Syarif Abdurrahman Mosque, *Radakng* traditional house, *Corak Insang* weaving, and traditional games were utilized as contextual representations of quadrilateral and triangle concepts, including rectangles, squares, trapezoids, rhombuses, and triangles. These cultural contexts were embedded throughout the worksheet in the form of learning activities, contextual illustrations, problem-solving tasks, and practice exercises, providing students with culturally familiar representations to support their understanding of geometric concepts. The illustrations and images incorporated into the worksheet were adapted to reflect ethnomathematical elements found in Pontianak local culture and were developed using the Canva application, which facilitated the creation of visually appealing and creatively designed instructional materials.

The developed student worksheet is organized into three main sections, comprising an introduction, a content section, and a closing section. The introductory section comprises several components designed to guide and support the learning process. It begins with a front cover displaying the worksheet title, topic, curriculum information, geometric illustrations, class details, and author identity, followed by an identity page containing detailed information about the student, author, advisor, validator, study program, and institution. The preface outlines the worksheet's purpose, content, and acknowledgments. A table of contents is included to facilitate navigation through topics, figures, and tables. The introductory section concludes with a material structure page presenting key components including the Pancasila student profile, learning outcomes, learning objectives, core questions, learning trajectory, and usage guidelines, ensuring that both teachers and students can effectively utilize the worksheet in the classroom.

The main content section of the developed ethnomathematics-based student worksheet serves as the core component where students actively engage in learning mathematical concepts through culturally relevant contexts. This section is organized into several parts, beginning with an introductory dialogue that links the topic of quadrilaterals and triangles to local cultural elements, such as the traditional *Radakng* house of Pontianak. The material section presents explanations and visual representations of geometric

shapes, illustrated through cultural artifacts like the traditional layered cake Lapis Legit. The activity section guides students in discovering mathematical formulas through inquiry-based learning, fostering conceptual understanding and retention. Additionally, group tasks encourage collaboration, while individual exercises assess students' comprehension. The practice questions are contextualized with ethnomathematical elements, incorporating images and scenarios derived from Pontianak's cultural heritage to make mathematics learning more meaningful, interactive, and locally grounded.

The closing section of the developed ethnomathematics-based student worksheet consists of a bibliography and a back cover design. The bibliography includes references used in the development process, such as academic articles discussing Pontianak's local culture and mathematics textbooks for seventh-grade topics on quadrilaterals and triangles, enabling readers to trace the original sources. The back cover presents a brief description of the student worksheet, highlighting the historical and cultural significance of landmarks such as the Kadariyah Palace and the Jami' Sultan Syarif Abdurrahman Mosque, along with an overview of the purpose behind developing the ethnomathematics-based student worksheet. This section not only provides academic credibility through proper referencing but also reinforces the cultural context that underpins the learning materials.

Figure 2. Cover of Student Worksheet

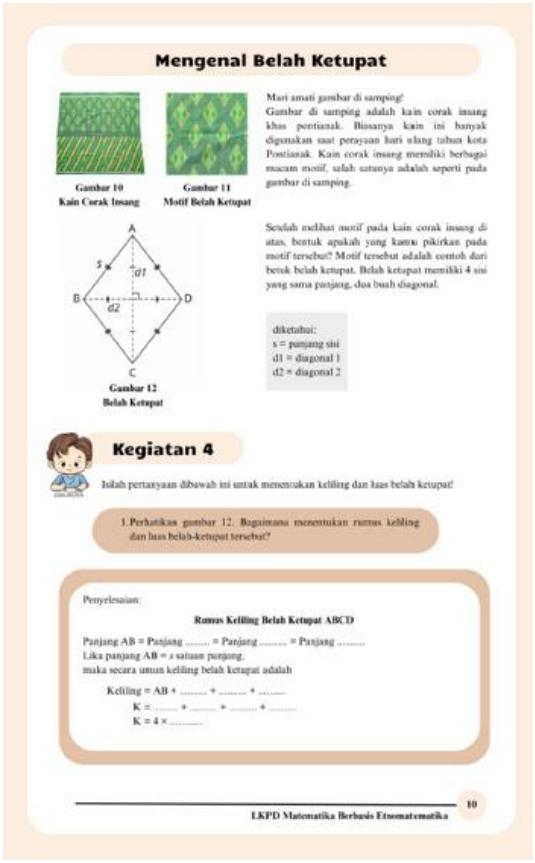

Figure 3. Introduction

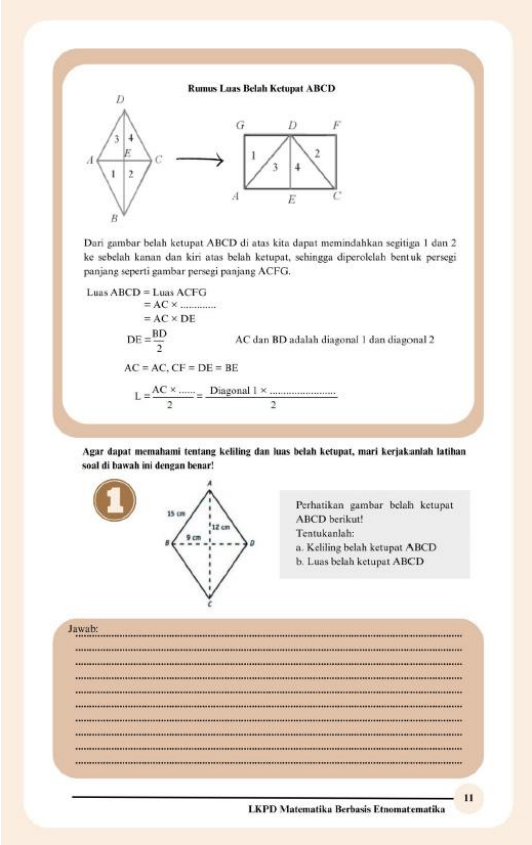

Figure 4. Core Content

Figure 5. Evaluation

Figures 1–4 illustrate the main components of the developed ethnomathematics-based student worksheet. Figure 1 presents the cover design incorporating geometric illustrations and Pontianak cultural elements to enhance students' interest and cultural familiarity. Figure 2 demonstrates the introductory section containing learning objectives, instructions, and contextual cultural orientation. Figure 3 displays the core learning activities integrating ethnomathematical contexts into quadrilateral and triangle materials through illustrations, contextual problems, and inquiry-based tasks. Figure 4 presents the evaluation section designed to assess students' conceptual understanding through culturally contextualized exercises. Overall, these components demonstrate the integration of local cultural contexts into geometry learning activities in a systematic and visually engaging manner.

Expert Validation and Revision

After completing the product design stage, the next step was the validation process, which included content, media, and language validation. The validation process was conducted by six experts in total, consisting of two subject matter experts, two media experts, and two language experts.The results of these three validation types were used to determine the level of validity of the developed student worksheet and served as the foundation for design revisions. These revisions aimed to refine the student worksheet to ensure its feasibility and readiness for classroom implementation. Feedback, comments, and suggestions from the validators, consisting of content, media, and

language experts, served as the primary basis for improvement.

The compilation of feedback and suggestions from the validators can be seen in Table 4, which summarizes the essential comments and recommendations provided by content, media, and language experts during the validation process.

Table 4. Compilation of Feedback and Suggestions from Validators

No	Area of Expertise	Feedback and Suggestions
1	Content Expert	The student worksheet is generally suitable for student use; however, several improvements are needed, including revising Figures 5 and 6, enhancing the solution illustration in Activity 3, and refining symbols and explanations in Activity 6.
2	Media Expert	Suggestions include adding descriptions in the table of contents for Activity 8, improving the use of symbols in figures, including the author's biography in the closing section, refining Activity 7, and adding an image on the front cover that reflects ethnomathematical elements.
3	Language Expert	The language and sentence structures used are appropriate overall, but revisions are needed to ensure the accuracy and consistency of symbols and explanations in the illustrations of parallelogram, trapezoid, and triangle figures.

The feedback provided by the three validators indicated that the initial prototype was generally acceptable but required improvements in several areas, including the accuracy of mathematical illustrations, symbol consistency, instructional clarity, and the alignment between ethnomathematical elements and learning activities. Based on these suggestions, the researcher revised the worksheet accordingly, refining figures and activity illustrations, improving the use of symbols in figures, enhancing explanations in parallelogram, trapezoid, and triangle illustrations, and adding an ethnomathematical image on the front cover. The revised prototype was then finalized and prepared for classroom implementation during the assessment phase.

Validation Results by Subject Matter Expert

The results of the content validation were analyzed using Gregory's index formula, while the practicality level was determined through percentage analysis. Content validation was conducted by subject-matter experts to ensure that the material in the student worksheet is conceptually accurate, aligned with the curriculum, and relevant to the ethnomathematics context. The validation process was carried out through the completion of standardized validation questionnaires by the experts. The assessment encompassed two primary components: content quality and material presentation.The inter-rater contingency matrix results from the content experts are presented in Table 5.

Table 5. Contingency Matrix from Subject Matter Expert

		Expert 1	
		Irrelevant (Score 1-3)	Relevant (Score 4-5)
Expert 2	Irrelevant (Score 1-3)	0	0
	Relevant (Score 4-5)	0	18

After obtaining the contingency data, the next step was to calculate the validity coefficient using Gregory's content validity formula, as shown in Equation (1). Based on the calculation results, the validity coefficient obtained from the assessments of the two subject-matter experts was 1.00. Referring to the expert agreement index, this value falls within the category of high validity. Therefore, it can be concluded that the content of the student worksheet is valid and appropriate for use in the learning process.

Validation Results by Media Expert

The media validation aims to ensure that the student worksheet exhibits an attractive visual design, clear and readable typography, consistent and coherent layout, and alignment between the content and the ethnomathematical context. The inter-rater contingency matrix results from the content experts are presented in Table 6.

Table 6. Contingency Matrix from Media Expert

		Expert 1	
		Irrelevant (Score 1-3)	Relevant (Score 4-5)
Expert 2	Irrelevant (Score 1-3)	0	0
	Relevant (Score 4-5)	0	19

After obtaining the contingency data, the validity coefficient was calculated using Gregory's content validity formula, as shown in Equation (1). The validity coefficient obtained from the assessments of the two media experts was 1.00. According to the validator agreement index, this value falls within the high validity category. Therefore, it can be concluded that the ethnomathematics-based student worksheet media developed in this study demonstrates a high level of validity and meets all evaluation aspects from the media experts.

Validation Results by Language Expert

The validation by language experts was conducted by two validators who assessed 4 aspects: clarity and communication, interactivity and dialogue, appropriateness for student characteristics, and the use of terms and symbols. The inter-rater contingency matrix results from the lenguage experts are presented in Table 7.

Table 7. Contingency Matrix from Language Expert

		Expert 1	
		Irrelevant (Score 1-3)	Relevant (Score 4-5)
Expert 2	Irrelevant (Score 1-3)	0	0
	Relevant (Score 4-5)	0	11

After obtaining the contingency data, the next step was to calculate the validity coefficient using Gregory's content validity formula, as shown in Equation (1). Based on the calculation results, the validity coefficient obtained from the assessments of the two language experts was 1.00. Referring to the validator agreement index, this score falls into the high validity category.

Therefore, it can be concluded that the linguistic aspects of the ethnomathematics-based student worksheet developed in this study demonstrate a high level of validity. The validity coefficient of 1.00 indicates complete agreement between validators regarding the relevance of the assessed aspects. This result suggests that the worksheet successfully met the expected standards in terms of content accuracy, media design, and language appropriateness. The high level of agreement may be attributed to the iterative revision process conducted during the prototyping phase, which incorporated validator feedback before the final validation.

Assessment

Following the validation stage, the ethnomathematics-based student worksheet was implemented in a classroom setting to assess its practicality during the learning process. Practicality data were collected through student response questionnaires covering ease of use, clarity of instructions, attractiveness of design, relevance of cultural content, and engagement in learning activities. The collected data were analyzed to examine students' perceptions of the worksheet's usability, clarity, attractiveness, and cultural relevance in geometry learning. The results of the practicality assessment are presented in Table 8.

Table 8. Students' Responses Questionnaire Results

Score Total	1489
Percentage Average	82.72%
Practicality Criteria	Very Practical

The developed student worksheet achieved a total score of 1489 out of a maximum possible score of 1800. With an average percentage of 82.72%, the student worksheet falls under the "very practical" category according to the established practicality criteria. The high practicality score indicates that students were able to use the worksheet with minimal difficulty. The contextual cultural content and visual presentation appeared to support students' engagement during learning activities. These findings suggest that the worksheet is feasible for classroom implementation and has the potential to facilitate more meaningful mathematics learning experiences. The high practicality score may be attributed to several factors. First, the instructions and learning activities were presented in a clear and systematic manner, enabling students to follow the tasks independently. Second, the integration of local cultural contexts made the learning materials more familiar and meaningful to students, thereby increasing their engagement. Third, the visual design and illustrations enhanced the attractiveness of the worksheet and supported students' understanding of quadrilateral and triangle concepts. These findings suggest that the developed worksheet is not only practical to use but also capable of supporting a more contextualized mathematics learning experience.

The ethnomathematics-based student worksheet developed in this study demonstrated high validity across content, media, and language aspects, as indicated by the perfect agreement among validators. In addition, the worksheet achieved a very practical level based on students' responses during classroom implementation. These findings suggest that the developed worksheet successfully met the essential quality criteria of instructional materials, including content appropriateness, visual design, linguistic clarity, and ease of use. Therefore, the developed student

worksheet can be considered a feasible instructional resource for supporting contextualized and culturally responsive learning of quadrilaterals and triangles at the junior high school level.

Discussion

The high validity results indicate that the developed ethnomathematics-based student worksheet integrating Pontianak local culture into quadrilateral and triangle topics successfully fulfilled the essential criteria of content accuracy, media design, and linguistic appropriateness for seventh-grade mathematics learning. The consistency of the validators' assessments suggests that the integration of Pontianak cultural contexts into quadrilateral and triangle materials was considered relevant and appropriate for supporting students' geometry learning. These findings demonstrate that local cultural elements from Pontianak can be systematically incorporated into quadrilateral and triangle learning materials without reducing the clarity and accuracy of mathematical concepts.

The perfect agreement among validators may be attributed to the iterative development process employed during the prototyping phase. Prior to the final validation, the worksheet underwent several revisions based on feedback from content, media, and language experts, focusing on enhancing the accuracy of mathematical illustrations, refining symbols and explanations in figures, and strengthening the alignment between ethnomathematical elements and the quadrilateral and triangle concepts presented in the worksheet. As a result, the final version was able to satisfy the expected quality standards across all evaluated aspects.

These findings are consistent with previous studies indicating that ethnomathematics-based learning materials can meet validity and practicality standards in mathematics education (Prilianti et al., 2018; Rachmawati et al., 2019). The integration of Pontianak cultural contexts into quadrilateral and triangle topics provided contextual representations through locally familiar objects encountered in students' daily environment, such as the geometric patterns found in traditional Pontianak woven motifs and architectural structures. Batiibwe (2024) argues that one of the most effective ways to make mathematics more relatable and meaningful is to engage learners in exploring mathematical ideas within their own cultural contexts, which aligns with the approach taken in the present study. Furthermore, Näslund-Hadley et al. (2025) demonstrated that a well-designed ethnomathematics program can improve both mathematical and ethnomathematical skills while simultaneously strengthening students' cultural identity, indicating that the integration of Pontianak cultural contexts into quadrilateral and triangle learning materials need not create a conflict between academic achievement and cultural belonging.

The practicality test yielded a score of 82.72%, categorized as very practical, indicating that the ethnomathematics-based student worksheet on quadrilaterals and triangles was considered easy to use and understandable by seventh-grade students during geometry learning activities. The integration of visual representations of Pontianak local culture, contextual illustrations, and guided activities related to quadrilateral and triangle concepts may have contributed to students' positive

responses toward the worksheet. This interpretation is consistent with the findings of Balacuit and Oledan (2024), who reported that ethnomathematics-based instruction fosters positive attitudes toward mathematics, including increased student interest and motivation. The familiarity of Pontianak cultural contexts presented in the worksheet may have further enhanced students' engagement and participation during quadrilateral and triangle learning activities. This is further supported by Garba (2024), who found that an ethnomathematics instructional approach enhances students' engagement and learning outcomes in geometry, suggesting that culturally grounded materials have a positive impact on student participation and long-term knowledge retention.

This result is particularly important given that the preliminary research identified a lack of contextual learning materials and limited student engagement during mathematics instruction, particularly in geometry topics such as quadrilaterals and triangles. The high practicality score suggests that the developed worksheet has the potential to address these instructional needs by providing Pontianak culturally relevant and student-centered learning activities on quadrilateral and triangle topics. In this regard, Marsigit et al. (2025) noted that while educators demonstrated the ability to creatively integrate cultural elements into mathematics, significant challenges remain in implementation, particularly in transitioning from traditional teaching methods to more student-centered approaches. This underscores the importance of providing well-structured and validated ethnomathematics-based materials, such as the worksheet on quadrilaterals and triangles developed in the present study, to support teachers in implementing culturally responsive mathematics instruction effectively. In this way, the worksheet not only serves as a practical instructional resource but also directly responds to the learning needs identified during the preliminary research phase.

In geometry learning, visual and contextual representations play an important role, as seventh-grade students frequently encounter difficulties in understanding abstract two-dimensional concepts, including spatial reasoning, visualization, and properties of quadrilaterals and triangles, often due to limited foundational knowledge (Manandhar, 2026). The ethnomathematical contexts drawn from Pontianak local culture embedded in the worksheet may help bridge this gap by situating quadrilateral and triangle concepts within familiar cultural objects such as traditional architectural forms and woven patterns, thereby creating more meaningful and relatable learning experiences for students. This finding aligns with Batiibwe (2025), who reported that ethnomathematics enables learners to recognize the relevance of mathematics in their daily lives by connecting mathematical concepts to familiar cultural contexts.

Overall, the findings confirm that the ethnomathematics-based student worksheet integrating Pontianak local culture into quadrilateral and triangle topics fulfilled the criteria of both validity and practicality. These results indicate that the developed worksheet is suitable for use as an instructional resource that supports seventh-grade students in learning quadrilaterals and triangles through culturally relevant and contextually meaningful representations drawn from their local cultural environment.

Implication

The findings of this study have important implications for mathematics teachers, educational policymakers, and future researchers. For mathematics teachers, the developed ethnomathematics-based student worksheet may serve as an alternative instructional resource for implementing contextual and culturally responsive geometry learning. By utilizing local cultural objects as representations of quadrilateral and triangle concepts, the worksheet enables teachers to connect abstract geometric ideas with students' everyday experiences and cultural backgrounds. Teachers may integrate this worksheet during the concept introduction phase, guided practice, or independent learning activities to facilitate a more meaningful and engaging learning process. This approach encourages teachers to explore the cultural potential of their local environment as a legitimate and enriching source of mathematical learning.

For educational policymakers, the findings suggest that local cultural elements can be systematically integrated into instructional materials without compromising mathematical rigor or curriculum standards. These findings may inform policymakers in formulating policies that support the development of culturally responsive mathematics curricula, particularly in regions with rich indigenous cultural heritage such as West Kalimantan. Policymakers are therefore encouraged to consider ethnomathematics as a viable framework within curriculum policy, supported by adequate funding, teacher professional development, and institutional guidelines that enable schools to produce culturally relevant instructional resources.

For future researchers, this study provides an empirical example of the development of a valid and practical ethnomathematics-based student worksheet grounded in Pontianak local culture for the topic of quadrilaterals and triangles at the seventh-grade level. Future studies may extend this approach to other mathematical topics as well as to different educational levels and broader cultural contexts. Researchers are also encouraged to investigate the effectiveness of ethnomathematics-based instructional materials in improving students' mathematical achievement, conceptual understanding, problem-solving skills, spatial reasoning, and cultural awareness. Furthermore, studies employing experimental or quasi-experimental designs may provide stronger empirical evidence regarding the impact of such materials on student learning outcomes.

At a broader level, this study affirms that local cultural contexts hold significant potential as a foundation for developing valid and practical mathematics instructional materials. The integration of cultural knowledge into classroom resources may contribute to learning environments in which mathematics is perceived as meaningful, relevant, and closely connected to students' social and cultural lived experiences, ultimately supporting more inclusive and culturally responsive mathematics education in Indonesia.

Limitation

Despite its promising outcomes, this study has several limitations that should be acknowledged when interpreting the findings. First, the study was conducted with only 30 seventh-grade students at a

single junior high school in Sungai Kakap, which limits the generalizability of the findings to students with different backgrounds, learning characteristics, or educational settings. Additionally, the validation process involved a limited number of expert validators, which may have influenced the breadth of feedback received during the development process.

Second, the scope of this study was limited to the development, validation, and practicality evaluation of the worksheet. As such, the findings provide evidence regarding the quality and usability of the developed material but do not address its effectiveness in improving students' mathematical achievement, conceptual understanding, problem-solving skills, spatial reasoning, or cultural awareness.

Third, the implementation phase was conducted within a relatively short timeframe and in a single classroom context. Consequently, the practicality findings reflect students' initial responses to the worksheet and may not fully capture its long-term impact on learning processes and outcomes.

These limitations suggest important directions for future research. Subsequent studies should involve larger and more diverse samples across multiple schools and regional cultural contexts to strengthen the generalizability of the findings. Furthermore, experimental or quasi-experimental designs are recommended to provide stronger empirical evidence regarding the effectiveness of ethnomathematics-based learning materials in improving students' cognitive outcomes, such as mathematical achievement and conceptual understanding, as well as affective outcomes, including motivation, cultural awareness, and attitudes toward mathematics learning.

CONCLUSION

This study demonstrated that the developed ethnomathematics-based student worksheet on quadrilateral and triangle topics successfully met the criteria of validity and practicality, demonstrating that culturally grounded geometry learning materials can be developed in a manner that is academically sound and contextually relevant for seventh-grade students. This study affirms that Pontianak local cultural elements can be systematically and meaningfully integrated into mathematics instructional materials without compromising mathematical rigor or curriculum standards.

The primary contribution of this study is the provision of a concrete and replicable model for developing ethnomathematics-based instructional materials that integrate Pontianak local culture into quadrilateral and triangle learning, a context and topic combination that has not been previously explored. This worksheet offers mathematics teachers and instructional material developers a practical reference for designing culturally responsive teaching materials that connect abstract geometric concepts with students' daily experiences and local cultural environments, particularly in West Kalimantan.

More broadly, this study reinforces the role of ethnomathematics as a meaningful bridge between cultural knowledge and mathematical understanding, contributing to the development of more contextual, inclusive, and culturally responsive mathematics education. Future studies are recommended to extend this work by examining the effectiveness of the developed worksheet in improving students' geometry achievement, conceptual understanding, and cultural

awareness through experimental designs involving larger and more diverse student populations.

REFERENCES

Anggraini, A., & Syahbrudin, J. (2021). Pentingnya Pengembangan Buku Ajar Statistika Berbasis Praktik Penyelesaian Masalah dalam Penelitian Pendidikan. *Jurnal Ilmiah Wahana Pendidikan*, *7*(2), 17–26.

Balacuit, I. C. P., & Oledan, A. M. B. (2024). A Systematic Review on Ethnomathematics Integration in Secondary Education. *Journal of Education and Practice*. https://doi.org/10.7176/JEP/15-9-01

Batiibwe, M. S. K. (2024). The role of ethnomathematics in mathematics education: A literature review. *Asian Journal for Mathematics Education*, *3*(4), 383–405. https://doi.org/10.1177/27527263241300400

Batiibwe, M. S. K. (2025). Ethnomathematics as a pedagogical tool for mathematics education: opportunities and challenges. *SN Social Sciences*, *5*(12), 221. https://doi.org/10.1007/s43545-025-01260-0

Cahirati, P. E. P., Makur, A. P., & Fedi, S. (2020). Analisis Kesulitan Belajar Siswa dalam Pembelajaran Matematika yang Menggunakan Pendekatan PMRI. *Mosharafa: Jurnal Pendidikan Matematika*, *9*(2), 227–238. https://doi.org/10.31980/mosharafa.v9i2.606

Faruq, U. (2023). Eksplorasi etnomatematika pada Masjid Jami'Sultan Syarif Abdurrahman Kota Pontianak. *Juwara Jurnal Wawasan Dan Aksara*, *3*(1).

Ferdian, N. C., Anwar, L., & Herdini, H. (2025). Validity and Practicality Test of e-Student Worksheets Using the ARCS (Attention, Relevance, Confidence, and Satisfaction) Model on Acid-Base Concepts. *International Journal of STEM Education for Sustainability*, *5*(1), 132–149. https://doi.org/10.53889/ijses.v5i1.584

Garba, A. (2024). Effects of ethno-mathematics instructional approach and problem-based learning strategy on students'interest, achievement and retention in geometry in benue state, nigeria. *Turkish Journal of Computer and Mathematics Education*, *15*(2), 65–90.

Jamilah, J., & Nurmaningsih, N. (2024). Eksplorasi Etnomatematika pada Tenun Corak Insang Melayu Pontianak. *Jurnal Riset Pembelajaran Matematika Sekolah*, *8*(1), 1–9.

Listari, D., Handayani, L., & Rustanuarsi, R. (2024). Eksplorasi Etnomatematika Pada Permainan Tabak Ditinjau Dari Materi Sekolah Dasar. *Al-'Adad: Jurnal Tadris Matematika*, *3*(1), 32–43.

Manandhar, D. C. (2026). Factors Affecting Students Difficulties in Learning Geometry: A Qualitative Study. *NPRC Journal of Multidisciplinary Research*, *3*(3), 216–231. https://doi.org/10.3126/nprcjmr.v3i3.92485

Marsigit, Irfan, M., & Sukoco, H. (2025). Evaluation of pedagogical quality in ethnomathematics learning practices. *Discover Education*, *5*(1), 25. https://doi.org/10.1007/s44217-025-01026-z

Näslund-Hadley, E., Hernández-Agramonte, J., Santos, H., Albertos, C., Grigera, A., Hobbs, C., & Álvarez, H. (2025). The effects of ethnomathematics education on student outcomes: The JADENKÄ program in the Ngäbe-Buglé comarca, Panama. *International Journal of Bilingual Education and Bilingualism*, *28*(5), 579–595. https://doi.org/10.1080/13670050.2024.2446987

Nurmaya, R. (2021). Pengembangan Bahan Ajar Berbasis Etnomatematika Pada Materi Transformasi Geometri. *RANGE: Jurnal Pendidikan Matematika*, *2*(2), 123–129.

Orey, D., & Rosa, M. (2021). From ethnomathematics to ethnomodelling. *Journal of Mathematics and Culture*, *15*, 148–168.

Plomp, T., & Nieveen, N. M. (2010). *An introduction to educational design research: Proceedings of the seminar conducted at the East China Normal University, Shanghai (PR China), November 23-26, 2007*.

Prahmana, R. C. I., Yunianto, W., Rosa, M., & Orey, D. C. (2021). Ethnomathematics:" Pranatamangsa" System and the Birth-Death Ceremonial in Yogyakarta. *Journal on Mathematics Education*, *12*(1), 93–112.

Prilianti, L. D., Kurniasih, D., & Fitriani, F. (2018). Analisis Kevalidan Lks Berbasis Hierarki Konsep Pada Materi Kelarutan Dan Hasil Kali Kelarutan. *Jurnal Pendidikan Informatika Dan Sains*, 68–77.

Putra, C. N. A., Muchtadi, M., & Hartono, H. (2023). Pengembangan Lembar Kerja Siswa Etnomatematika Jajanan Pasar Tradisional Kota Pontianak Pada Materi Bangun Ruang Sisi Datar. *Jurnal Prodi Pendidikan Matematika (JPPM)*, *5*(1), 545–553.

Rachmawati, Y., Maizora, S., & Maulidiya, D. (2019). Validitas lembar kerja peserta didik (lkpd) berbasis discovery learning pada materi bangun datar segiempat di kelas vii

smp negeri 1 bengkulu tengah. *Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS)*, *3*(2), 162–171. https://doi.org/10.33369/jp2ms.3.2.162-171

Retnawati, H. (2016). *Analisis Kuantitatif Instrumen Penelitian (Panduan Peneliti, Mahasiswa Dan Psikometrian)*. Parama Publishing.

Ridha, A. A., & Komalasari, K. (2024). Kajian etnomatematika pada arsitektur bangunan rumah melayu pontianak tampak samping kiri dalam meningkatkan pemahaman geometri bangun datar dan bangun ruang sisi datar. *Al-'Adad: Jurnal Tadris Matematika*, *3*(1), 91–99.

Rosa, M., & Orey, D. C. (2020). Principles of culturally relevant education in an ethnomathematical perspective. *Revista de Educação Matemática*, (17), 1.

Sholihah, M., Widadah, S., & Sukriyah, D. (2022). *Development of Student Worksheet Based on Ethnomathematics Traditional* Engklek *Games on Cube and Rectangular Pyramid*. https://doi.org/10.2991/assehr.k.211229.023

Sulisti, H., Handayani, L., & Rustanuarsi, R. (2025). Analisis Pendahuluan Pengembangan LKPD Berbasis Etnomatematika pada Materi Segi Empat dan Segitiga. *Jurnal Padegogik*, *8*(1).

Vitoria, L., & Monawati. (2020). Developing ethnomathematics-based worksheet to teach linear equations. *Journal of Physics: Conference Series*, *1460*(1), 012021. https://doi.org/10.1088/1742-6596/1460/1/012021